I then stated has been allowed by Dr. Gray, as he has returned the skull of *Scapia Falconeri* to this museum on the strength of my representation.

Before concluding, I may observe that I have never asked Dr. Gray, on any occasion, for his opinion of Dr. Fleming, and that I never had the privilege, while a student, to be a regular member of Dr. Fleming's class; and under these circumstances I object to Dr. Gray's Chelonian method being applied to me.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

May 30, 1872.—George Biddell Airy, C.B., President, in the Chair.

"On the Structure and Development of the Skull of the Salmon (*Salmo salar*, L.)"* By William Kitchen Parker, F.R.S.

A few years ago Mr. Waterhouse Hawkins put into my hands some newly hatched salmon and also three of the first summer. Seeing their fitness for embryological research and the interest attaching to the formation of an osseous fish, I applied to my friends Messrs. Frank Buckland and Henry Lee, and these gentlemen most liberally supplied me with a large number of unhatched embryos and of the "fry" of this large fish.

My last subject, the frog, being fairly out of hand, I set myself last summer to this newer and more easy task,—more easy by far; for the translucency of the young salmon contrasts most favourably with the obscurity of the embryo frog.

I found that the two types at the time of hatching did not start fairly, but that the salmon had hastened to finish its *fourth stage* before emerging from the egg; this, however, is partly in consequence of the difference of the envelope in which the embryos are contained; for in the salmon this is a leathery "chorion," and in the frog a mere gelatinous bleb.

Moreover it soon became apparent that these two "Ichthyopsidans" are in no wise near akin to each other. In the very first stage, where there is an essential agreement, in one important particular they greatly disagree; for the embryo of the salmon has two arches in front of its mouth, while the tadpole has but one; there is also an additional gill-arch in the osseous fish.

In the earliest stage of the salmon worked out by me I found a

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may believe, and however absurd the Title, we can assure him it stands in his own hand-writing—at the head of the MS. The only alteration, fortunately, which I ventured to make was the substitution of a *P* for *p* in *Phayrei*.—W.F.]

* Being an abstract of the Bakerian Lecture.

much more distinct condition of the parts than in frogs at the same stage; the differentiation of the latter is obscure as compared with the fish, and this not merely because of the quantity of *pigmentum nigrum* in its tissues.

Then, in addition to other causes of obscuration, the mouth of the tadpole is strangely modified in harmony with its "suctorial" character and affinities (showing a remarkable affinity to the mouth of a lamprey), so that a whole system of cartilages has to be eliminated from the lips before the mouth (proper) can be understood. The labial system is slightly and slowly developed in the salmon, and its mouth is thus much more in harmony with that of the embryo reptile or bird than with that of the tadpole.

After the simple stage is passed, the development of the facial arches is very different in the two types—as different, indeed, as in any two possible examples that could be given in the whole vertebrate group.

The facial arches behind the mouth now undergo segmentation—first the hyoid, and then the mandibular. The hyoid is cloven from top to bottom and also has a single distal piece separated off.

At this stage we get an explanation of what is seen in certain rays, where the hyoid suspensorium is permanently double; and also ascertain that this second postoral arch, which retains the anterior piece in relation to the skull as the great "hyomandibular" pier, does not need the *saw* of the transcendentalist to put it into proper relation to its surroundings. Nature's invisible *wedge* has done what was needed, and the supposed *double rib* turns out to be *half* a visceral arch. On the whole, this second stage is extremely "Plagiostomous," for the details of which I must refer to the main paper.

While in the egg the head of the embryo is flattened, and so twisted that one of the eyes (it may be the left or the right) looks upwards towards the "chorion," the other having a *visceral* direction.

The facial bars, at first having all a simple sigmoid form, rapidly change towards the time of hatching; and when the head gets free, the cerebral vesicles speedily swell, taking on the form so familiar to the embryologist; and the head now gains the "mesocephalic flexure."

After this an approach is made to the Teleostean type of structure; but this is not done at a stride. The intermediate condition is thoroughly "Ganoid," and, happily, comes in to explain the related structures of the *older* and *newer* "Orders." I am not aware that any stage of the heart or of the intestines shows either the many valves of the "aortic bulb" or the intestinal spiral valve; this must be seen to; yet if these never show themselves in the "fry" of the osseous fish, their absence does not affect the general skeletal morphology.

The salmon amongst fishes, like the fowl amongst birds, never attains to the greatest degree of special class-modification; it remains *subtypical*, with a dentigerous maxillary, a ductus pneumaticus, a very *chondrosteous* state of the skull, and a very heterocercal tail.

Yet, from an ichthyological point of view, this fish is an immense height above the Sharks and Rays, and is far in advance, as a fish, of the whole group of "Ganoids."

The results of the *gradational* study of the fish-forms by the zoologist, and of their *secular* study by the palæontologist, are both in harmony with morphological facts. Although the light obtained is but as the first streak of dawn, yet it is a pleasant light, and quite sufficient to show each kind of worker where and how to renew his own special toil.

I cannot close this brief abstract without remarking that my researches in these, the highest types of animals, seem to me to be in perfect accordance with the results obtained by long study of the very lowest, the Rhizopods—namely, that they both yield increasing evidence in favour of the doctrine of Evolution.

Researches of this kind show what the life-processes can accomplish in the history of one individual animal, and also that the morphological steps and stages are not arbitrary, but take place in a manner in accordance with all that has of late been revealed to us of the gradation of types in the ages that are past.

June 20, 1872.—Sir James Paget, Bart., D.C.L., Vice-President, in the Chair.

"Notice of further Researches among the Plants of the Coal-measures." By Professor W. C. Williamson, F.R.S. (in a Letter to Dr. Sharpey, Sec. R.S.

Fallowfield, May 3, 1872.

My dear Dr. Sharpey,—In my memoir on Calamites, published in the last volume of the 'Philosophical Transactions,' I gave two figures of sections of a plant (plate 25. fig. 16 and plate 28. fig. 39) supposed to be a Calamite, but respecting the Calamitean nature of which I expressed my doubts in a note at the foot of page 488. I have now got numerous examples of this plant; and it proves, as I surmised, to belong to a distinct type. It has a branching stem, *not* jointed, and having a remarkable pith. Since the latter organ, when divided transversely, gives a star-shaped section, closely resembling that of a Calamite, except that it has not been fistular, I propose to give to the plant the generic name of *Astromyelon*. I have further examined a series of curious stems which I described briefly at the Edinburgh Meeting of the British Association under the name of *Dictyoxylon radicans*; this plant I also find must be placed in a new genus. It is characterized by possessing an exogenous, woody, branching stem, composed of reticulated vessels. It has no pith; and its bark consists of cells arranged in columns perpendicular to its surface. I think it not improbable that this has been the subterranean axis of some other plant, since I have succeeded in tracing its ultimate subdivisions into rootlets. I propose for the present to recognize it by the generic name of *Amyelon*. My specimens of this plant are very numerous, some of them having been kindly supplied to me by Messrs. Butterworth and Whittaker, of Oldham.

They may prove to be rhizomes and roots of the Asterophyllite described in my last letter to you.

Of this last genus I have just got an additional number of exquisite examples, *showing not only the nodes but verticils of the linear leaves so characteristic of the plant.* These specimens place the correctness of my previous inference beyond all possibility of doubt, and finally settle the point that *Asterophyllites* is *not* the branch and foliage of a Calamite, but an altogether distinct type of vegetation having an internal organization peculiarly its own. This organization is identical in every essential point with that of my *Volkmannia Dawsoni* already referred to in my previous letter, and which I now do not hesitate to designate *Asterophyllites Dawsoni*. The peculiar triquetrous form of the young vascular axis of this genus is too remarkable and too distinct from that of all other Carboniferous types to be mistaken for any of them, and especially for that of Calamites, with which it has not one single feature of real affinity.

I have also obtained, partly through the assistance of Messrs. Butterworth and Whittaker, but especially the latter, an instructive series of specimens of the genus *Zygopteris*, which has recently been made the subject of an important memoir by M. B. Renault, published in tome xii. of the 'Annales des Sciences Naturelles.' Our Lancashire specimens are of the type which he describes under the name of *Z. Lacattii*. The French savant has found these plants, in one instance, connected as petioles to a rhizome which he believes to be that of a fern. Our specimens supply some information additional to that published by M. Renault: they appear to me to sustain his idea that they are petioles; and I have traced in them the origin of the two vascular bundles which he refers to as pores existing in the bark. I find much reason for concluding that they are, as he surmises, the vessels going to the secondary rachis of the pinnules. Our Lancashire specimens are covered with sparse but very distinct hairs that, unlike the ramentaceous form common amongst ferns, are perfectly cylindrical. Whilst I am thus inclined to express my conviction that M. Renault is correct in his views respecting *Zygopteris*, I find it increasingly difficult to distinguish fragments of ferns from those of Lycopods, as also fragments of petioles from those of roots.

Mr. Nield and Mr. Whittaker, of Oldham, have just supplied me with two magnificent stems of Calamites of large size. The pith is absent from both, except some slight traces at the node of one of the specimens. I find on dissecting these matured stems that the remarkable arrangements of the vascular structure seen in plate 23. figure 2 of my memoir on Calamites almost entirely disappear in the more external of the exogenous growths. The conspicuous vertical laminæ of cellular parenchyma (my primary medullary rays), which separate the woody wedges, rapidly diminish in size as they proceed from within outwards, becoming more or less like the *secondary* or ordinary medullary rays represented in my fig. 5. Many of them, however, retain the evidence of their primary medullary origin in

their unusual length, and in consisting of two, or even three, vertical series of cells instead of one, as is usual with the secondary rays. The vessels pursue their longitudinal course across the node undeflected in any direction, save where they bend aside to allow the passage outwards of vascular bundles going off to the aërial branches*, as represented in my figures 13 and 38. Thus in the exterior parts of these large stems the ligneous zone exhibits little or no indication of the presence of a node, except what these divergent bundles afford. I find that these bundles slightly increase in size as they proceed from within outwards, showing that they share in the exogenous additions made to the exterior of the ligneous zone; in one of my stems that zone has a circumference of seven inches, and in the other of six and three quarters. It is in the former one that I find the nodal bundles; but I have not seen one of these organs whose actual diameter exceeds three sixteenths of an inch, confirming my previous statements respecting the comparatively small size of the aërial branches. As in my previously described examples, these bases of branches exhibit no separation of the vessels into a circle of wedges like those of the parent stem. The persistent growth of the vascular bundles just described seems to indicate more permanent relations between them and the central stem than I once thought probable. There appears to be a close approximation to uniformity in the number of the woody wedges of these large stems; one of mine contains 85, and the other 83 such. Mr. Binney counted 73 in his large specimen (*loc. cit.* pl. 2. fig. 1). In the thin, young woody cylinder represented in my fig. 19, the mean diameter of which was slightly over an inch, the number was also about 80. This close resemblance between stems so different in age and size again illustrates another of my previous statements, viz. that age produces no increase in the number of the woody wedges, but that each one of the latter enlarges by successive additions to its peripheral portions of new laminæ, which latter partly fill up the increasing area of the enlarging circle, and partly encroach upon the primary medullary rays, as represented in my figure 17, in addition to some interstitial growth.

We thus learn that as the ligneous cylinder of a Calamite increased in age and size it gradually exhibited less and less of the Calamitean peculiarities seen in young stems; its external portions assumed a generalized, unsulcated form, which recurs with remarkable uniformity in several otherwise different plants of the Coal-measures.

Amongst the Burntisland fossils sent to me by Mr. Grieve I find two very curious stems, probably of the same general nature as *Zygopteris*. Both have a dense outer cortical layer, with vascular bundles in the interior. In the simpler of these plants the transverse section of this bundle is crescentic; but in the concave border of the crescent are two small projecting capes dividing it into three minor bays (fig. 2). In the other the vascular axis is a double one, lodged in a somewhat elliptical stem: one of these is a simple crescent, the con-

* This condition is very correctly represented in plate 3. fig. 3 of Mr. Binney's memoir on Calamites (Palæont. Soc.).

cavity of which is directed inwards; the other has a very elegant transverse section (fig. 1). It is shaped like a dumb-bell, one head of which rests within the concavity of the crescentic bundle, and the other turns in the opposite direction; at each of these two extremities the margin of the dumb-bell is excavated into a small bay, as if a vertical canal had existed at each point; but these seem to have been merely columns of cellular tissue encroaching upon the rounded outline of the vascular structures. I propose provisionally to recognize these two forms under the generic name of *Arpexylon*.

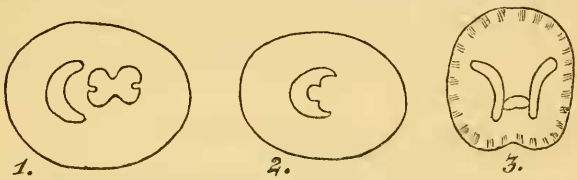

Fig. 1. *Arpexylon duplex.* Fig. 2. *Arpexylon simplex.* Fig. 3. *Edraxylon.*

Fig. 3 represents a stem or petiole in which the section of the vascular bundle presents the form of a chair or seat, and to which I propose to assign the name *Edraxylon*. This form exhibits numerous modifications of the pattern represented in the outline, down to a single central vascular bundle. It may prove to belong to *Dictyoxylon Oldhamium*.

MISCELLANEOUS.

On the Specific Name of the Black Redstart.

By Alfred Newton, M.A., F.R.S.

Dr. Gray's note "On the name *Tethya* and its Varieties of Spelling" in the last Number of the 'Annals' (p. 150) reminds me of a still greater diversity which has long existed among ornithologists as to the spelling of a name which at first sight looks as if it might have something in common with that of *Tethya*.

In 1769 Scopoli (Annus I. Historico-naturalis, p. 157) characterized a now well-known bird as "*Sylvia tithys*," with a reference to "*Linn.* S. N. XI. n. 23." The eleventh edition of Linnæus's great work is not at present accessible to me; but it was notoriously a mere reprint of his tenth edition (1758), of which a copy is now before me. Here (i. p. 187) we have the 23rd species of the genus *Motacilla* designated "*Titys*," and a reference to "*Fn. svec.* 227;" but this, as Linnæus in his twelfth edition (i. p. 335) allowed, was the female of his *M. phœnicurus*, and Scopoli was unconsciously the first to give a binomial title to the species we now know as the Black Redstart; in so doing, however, he misspelt the word, introducing an *h* into the name, and in consequence opened a door for a great number of future errors, while puzzling naturalists to account for it.

Linnæus, in his mode of spelling, copied Gesner, who in 1555 (Hist. Anim. iii. p. 719) has *titys*; but the latter also mentions that